

Detector for Advanced Neutron Capture Experiments (DANCE)

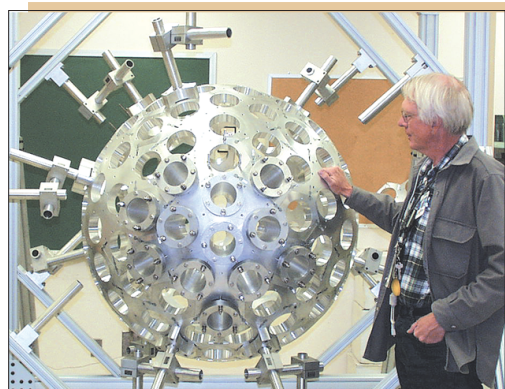
DANCE is designed to study neutron capture reactions on small quantities (1 mg) of radioactive nuclei. Dance's unique soccer-ball detector collects nearly all gamma rays from reactions between the selected target materials and the neutron beam. It is designed to study short-lived radioisotopes that are important in weapons physics, radiochemistry and element formation in stars. The flight path consists of four discrete collimators each consisting of alternating copper and borated polyethylene layers with changeable inserts. The last collimator ends 19.2 m from the moderator, and the target location is designed to be at 20.5 m. The last collimator is 0.6 cm in diameter, which results in a beam spot that is uniform out to $r = 0.3$ cm at the target location and falls to 1/100 of the central flux by $r = 0.75$ cm.

The BaF_2 array is designed to be separated into two sections and can be opened to install various targets. The radioactive targets are sealed in evacuated 2-in.-diam beam pipes at C Division's radioactive-isotope-handling facilities so that no handling of radioactive material is required at the Lujan Center. Various configurations of gamma shielding and neutron absorbers are used around the target pipe as required by the individual target characteristics. The neutron beam flux is monitored using the ${}^6\text{Li}(n,\alpha)$ reaction by a beam monitor downstream of the detector.

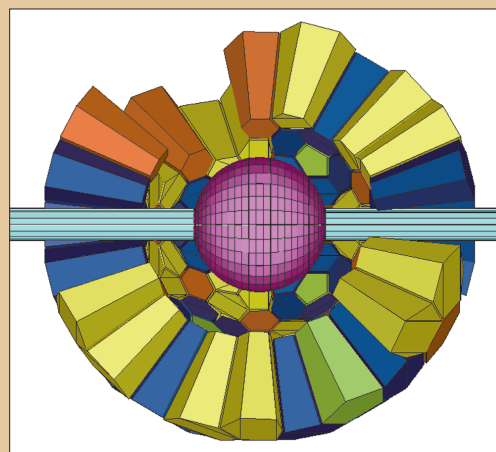
The detector consists of 160 barium fluoride crystals of four different shapes in a soccer ball array. The crystals cover completely the surface of a sphere, except for a port for the beam pipe. The detector will measure all the gamma rays emitted following neutron capture above a threshold of approximately 100 keV with a γ energy resolution of 12%.

The construction of the FP is nearly complete. The mechanical support for the advanced detector has been constructed and barium fluoride crystals are arriving from the manufacturer. We anticipate completion of the full array in the summer of 2002. At that time, a program of measuring several targets a year will be started. In the meantime, measurements on less demanding targets will be made with a partial array.

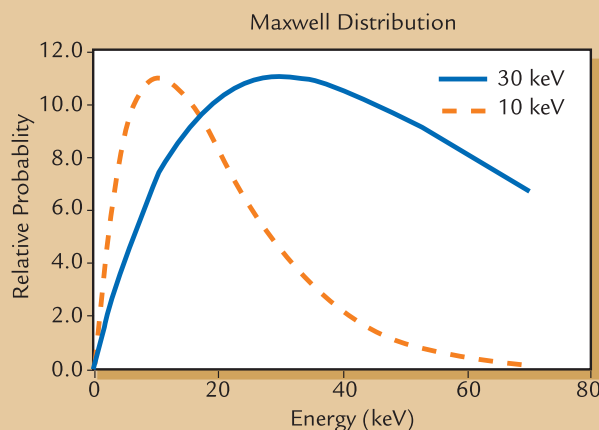
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John Ullman of LANSCE-3 examines the DANCE support structure.



Schematic representation of DANCE.



The synthesis of elements in s-process stars uses neutrons with a Maxwell distribution of energies corresponding to temperatures of 10 and 30 keV. This energy range is easily studied at the Lujan Center.